# 6.0 JHT and UTILITIES

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## 6.1. Capital Work

### 6.1.1 E-240 A-D – Splitter Overhead Condenser

All four units were completely retubed after extensive knife edging was noted on the east side of the exchangers. The knife edging occurred in the tubes on either side of the middle baffle and in the tubes near the inlets.

After the corrosion was discovered, inspections recommended installing ferrules or tube sleeves on the thinned tubes. After discussing the issue with metallurgy (Jessica Stankiewicz) and inspections (Joe George) we decided to use carbon steel ferrules. The bundles were 30 years old and nearing end of life, so tube replacement was necessary at the next turnaround. Carbon steel would provide adequate life for a five year run.

After consulting with Corrosion Monitoring Services, Inc. (CMS) we decided to use 1" 14 gauge SA-179 ferrules. These were the only ferrules that were available in our timeframe. Alloy ferrules (Inconel) were not available for 1 ¼" tubes.

The ferrules were installed in a few days by CMS. After the ferrules were installed, questions arose about whether the repair was valid. A meeting was called with Inspections (Dan Mason, Joe George), Engineering (Garth Jolly, Craig Dillon, Matt Greenfield, Doug Shotwell), and Materials (Pete Risse, Jessica Stankiewicz). Pete Risse was unconvinced that the ferrules were adequate to prevent further corrosion from Perchloroethylene. The "vapor gap" between the outside of the ferrule and the inside of the tube was viewed as an area where corrosion could continue (see **Figure 6.1.1.1**). It was decided in the meeting that no ferrule (alloy, carbon steel, thin-walled, thick walled, etc.) would relieve these fears and that a retube was necessary.

Peter Risse, materials engineer, believes that the corrosion mechanism is caused by chlorides that enter the JHT as 1 S/C "Hot Feed" from #4 Crude Unit. This stream enters the JHT downstream of V-220, a high pressure separator, and upstream of C-240, the Jet Splitter. This explains why there is no corrosion in E-216, the reactor effluent cooler. It was the reactor effluent cooler in the NHT that experienced rapid corrosion rates during the high chloride event in that unit. Because the E-216's showed no corrosion, we were at a bit of a loss as to the cause and mechanism of the corrosion.

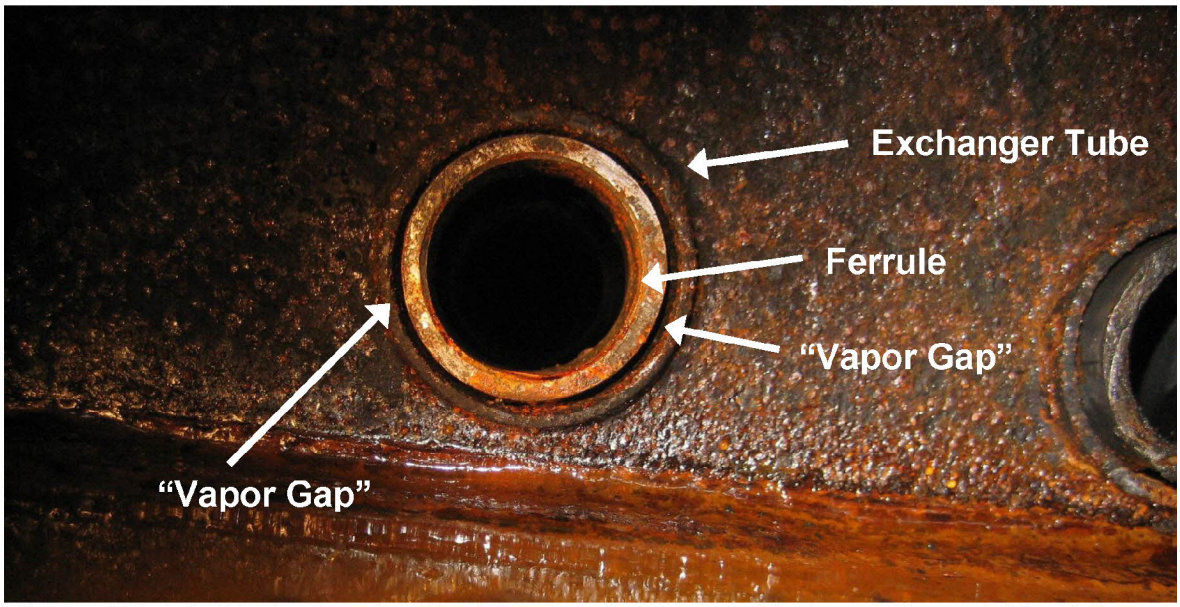


**Figure 6.1.1.1** Photo showing the infamous "vapor gap" between the outside of the ferrule and the inside of the exchanger tube.

The retube was performed by Phoenix Services out of Texas, who received a strong recommendation from Pascagoula's Reliability Group. In addition to the high recommendation, Phoenix Services was selected based on their ability to start immediately and work a day and night shift. The only other contractor we could get to consider this job was Matrix. They could not start for another two weeks and could only work day shift.

The bundles were replaced in-kind with 1 ¼" OD x .109" min. wall SA-179 tubes with embedded (non-serrated) aluminum fins. During the removal of the old tubes, some mechanical damage was noted on the tubesheet. A "go – no go" gage was fabricated and used to determine the integrity of the tubesheet based on API and TEMA tolerance specifications. Based on this data, two holes in the tubesheet were plugged and seal welded (without tubes).

After all the tubes were installed, the exchanger went though a unique hydrotest. The unit was brought up to 90 psi for 1 hour and then depressurized. This process was repeated 3 times to ensure that the tube rolls were good.

A drop folder is located in the D&R library under "E-240 Retube" with more detailed information.

*Ref S/D EWO BF426-E1 Rev 0 "Install Ferrules"*
*Ref S/D EWO BF426-E2 Rev 0 "Plug Header Box Tube Hole"*
*Ref S/D EWO BF426-E2 Rev 1 "Hydrotest Procedure"*

### 6.1.2 E-245 – Seal Flush Oil Cooler

This hairpin exchanger was replaced in-kind due to a thinning nozzle. There was some confusion with the tubesheet gaskets. The correct gaskets are oval ring (not octagonal) and can be purchased from Brown Fin Tube (AKA Koch Heat Transfer).

*Ref S/D EWO BF433-E1 Rev 0 "Replacement in-kind"*
*Ref S/D EWO BF433-E2 Rev 0 "Coating"*
*MR# 202527*

## 6.2. Piping

### 6.2.1 Miscellaneous Temporary Piping

*Ref S/D EWO BF108-E1 Rev.0*
*Ref S/D EWO BF108-E2 Rev.0*
*Ref S/D EWO BF108-E3 Rev.0*
*Ref S/D EWO BF108-E4 Rev.0*
*Ref S/D EWO BF108-E5 Rev.0*
*Ref S/D EWO BF409-E1 Rev. 0*

### 6.2.2 JHT - Process Valves

*Ref S/D EWO BF102-E1 Rev.3*
*Ref S/D EWO BF102-E2 Rev.2*
*Ref S/D EWO BF102-E3 Rev.1*
*Ref S/D EWO BF102-E4 Rev.1*
*Ref S/D EWO BF102-E5 Rev.1*
*Ref S/D EWO BF102-E6 Rev.1*
*Ref S/D EWO BF102-E7 Rev.1*
*Ref S/D EWO BF102-E8 Rev.1*
*Ref S/D EWO BF104-E1 Rev. 0*

**RECOMMENDATION**: Large amounts of valves were added to the worklist as a result of hydrotesting. I would recommend that all flanged valves are blinded rather than blocked in. This should reduce the number of valves replaced.

### 6.2.3 Utilities – Process Valves

*Ref S/D EWO BG102-E1 Rev. 1*

**RECOMMENDATION**: Large amounts of valves were added to the worklist as a result of hydrotesting. I would recommend that all flanged valves are blinded rather than blocked in. This should reduce the number of valves replaced.

### 6.2.4 C-240 – Remove Dead-Leg Piping from Min. Flow Bypass

Removed a non-functioning minimum flow bypass with two dead legs and replaced with a standard bypass. The globe valve was relocated on the new bypass to allow better operator access.

*Ref S/D EWO BF115-E1 Rev. 0*

### 6.2.5 P-246A – Install New Seal Flush Piping

Replaced "in-kind" the threaded seal flush piping on P-246A with seal welded pipe. This repair was done to upgrade the seal flush piping to match that of P-246. All connections (except instrumentation) were seal welded.

*Ref S/D EWO BF116-E1 Rev. 0*

### 6.2.6 E-216 - Replace Water Wash Piping and Change the Injection Quills

The water wash piping on the E-216 fin fans was replaced due to corrosion under insulation. The replacement was in-kind, except for the injection quill, which was upgraded to Hastelloy C. The design of the injection quill was also modified to allow the nozzle to sit into the center of the process pipe and shoot downward, with the flow of process. This change was made to accommodate "best practices" that were written after the original design was installed. The Hastelloy C upgrade was necessary per conversations with Peter Risse in Materials. The old carbon steel nozzles did have significant corrosion upon removal.

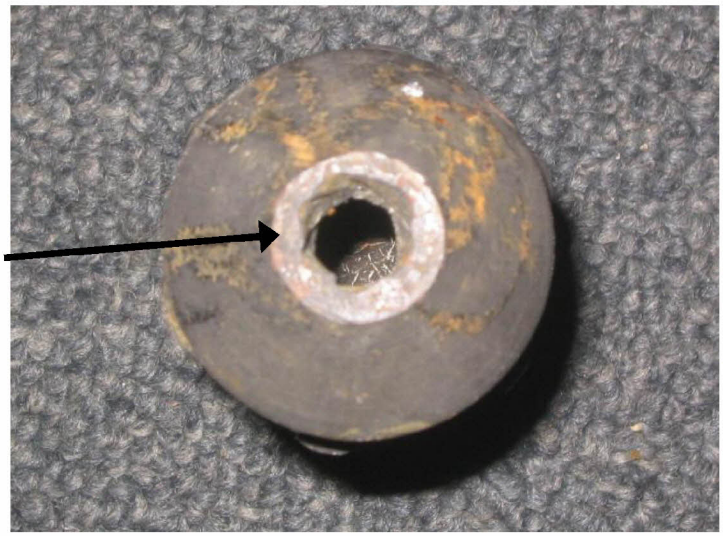


**Figure 6.2.6.1.** Corrosion on old carbon steel E-216 water wash nozzles

*Ref S/D EWO BF117-E1 Rev. 0*
*MR# 199795*

### 6.2.7 E-216 - Inlet Header Replacement

The inlet header to the E-216's was replaced due to a defect in the pipe which was causing it to delaminate. The replacement was in-kind, except for the addition of flanges for hydrotesting. Flanges were added at the exchanger inlets and at the 18" tee on the upstream side of the repair. The entire header was raised ~11" to accommodate the new flanges and to allow for operator access to the flange studs. The EWO was revised to allow the hydrotesting of the twelve 6" flanges through the exchangers, and the hydrotest pressure was lowered to 975 psi based on the E-216 test pressure.

*Ref S/D EWO BF117-E2 Rev. 1*
*Ref S/D EWO BF117-E2 Rev. 2*

### 6.2.8 P-247 – Replace Seal Flush Piping

A small clamped section of seal flush piping was replaced in-kind. The EWO was revised to add a set of flanges to make hydrotesting easier.

*Ref S/D EWO BF118-E1 Rev. 1*

### 6.2.9 P-257/A – Replace Seal Flush Piping

Two sections of pipe on P-257 and two sections of pipe on P-257A were replaced because of corrosion under insulation. In the process of repairing the corroded pipe, the contractor lost a small spool. The spool was replaced in-kind except for the ¾" needle valve which had too long of a lead time. The valve was replaced with a ½" valve and was butt welded to two ½"- ¾" swages.

*Ref S/D EWO BF119-E1 Rev. 1*

**RECOMMENDATION:** Consider replacing the ½" needle valve with a ¾" needle valve next turnaround. The ¾" needle valve has a 10 week lead time.

### 6.2.10 P-211 – Upgraded Backflow Prevention

The backflow prevention to P-211 was upgraded by replacing a 10" check valve in-kind (to verify integrity) and by upgrading two flow control valves to Class IV shutoff. The EWO originally included Honeywell control changes, but this was scrapped because the logic changes only fixed problems by causing other

problems. It was determined though a series of meeting to do nothing to the Honeywell control. The drop folder in the D&R library has more information on the decision process and the "best practice" discussions with subject matter experts.

*Ref S/D EWO BF120-E1 Rev. 1*
*Ref Drop Folder in D&R Library*

### 6.2.11 E-212 B to E-213B Bypass

Piping was replaced on the bypass due to corrosion under insulation. The piping was coated with system 12.1 and reinsulated to existing thickness (1 ½").

*Ref S/D EWO BF125-E1 Rev. 1*

### 6.2.12 E-212A to E-213A Bypass

Piping was replaced on the bypass due to corrosion under insulation. The piping was coated with system 12.1 and reinsulated to existing thickness (1 ½").

*Ref S/D EWO BF126-E1 Rev. 1*

### 6.2.13 #2 S/C – Replace Bypass Due to CUI

The bypass on FV-02115 was replaced because of CUI. The replacement piping was coated with system 12.1 and reinsulated.

*Ref S/D EWO BF127-E1 Rev. 0*

### 6.2.14 150# Steam – Removed Failed Dead-Leg

A failed dead leg was removed from a 150# steam line in the JHT. The line was cut just past the last two active branch connections and a blinded valve was added per operations request.

*Ref S/D EWO BF129-E1 Rev. 0*

### 6.2.15 150# Steam – Replace Failed Line Near Strahman Mixer

Replaced piping near the Strahman Mixer near T-3142 in-kind due to corrosion under insulation.

*Ref S/D EWO BF131-E1 Rev. 0*

### 6.2.16 V-220 – Replaced Lost level Gauge Piping

Replaced in-kind a small spool of piping that was lost by the contractor.

*Ref S/D EWO BF132-E1 Rev. 0*

### 6.2.17 P-3251A – Replace Corroded Seal Flush Piping

Replaced in-kind 15 linear feet of internally corroded seal flush piping.

*Ref S/D EWO BG115-E1 Rev. 0*

### 6.2.18 V-1171 – Replace Continuous Blowdown Line

Repair performed to eliminate a leak seal clamp. After performing initial repair, an additional 70' was added by inspections due to thinning pipe. In total, approximately 75' of pipe was replaced "in-kind".

*Ref S/D EWO BG117-E1 Rev. 1*

### 6.2.19 C-1180 – Debottleneck Overhead Line

Overhead line from the crude unit was increased from 2" to 6" at the tie-in point near V-3211. Removing this restriction should improve C-1180 operation on warm days.

*Ref S/D EWO BG118-E1*

### 6.2.20 V-3206 – Replace Leaking Level Gauge Piping

Replaced "in-kind" a small section of level gauge piping that was leaking.

*Ref S/D EWO BG120-E1*

### 6.2.21 Utilities – Steam Header Repairs

Various repairs to the 50#, 150#, 500#, and 850# steam systems in the Utilities plant. Isolation valves were installed at the sources and at the traps so the piping between these points can be installed on the run.

*Ref S/D EWO BG121-E1 Rev. 1*
*Ref S/D EWO BG121-E2 Rev. 0*

## 6.3. Furnaces

### 6.3.1 F-210A/B Inspections Notes

Furnaces were in good shape overall. There were some small refactory and snuffing steam repairs. It was noted in F-210A that one of the tubes is not sitting on the hanger. This was also observed in the 2002 S/D, so we did not perform any repairs. There were some bad burners that can be replaced on the run.

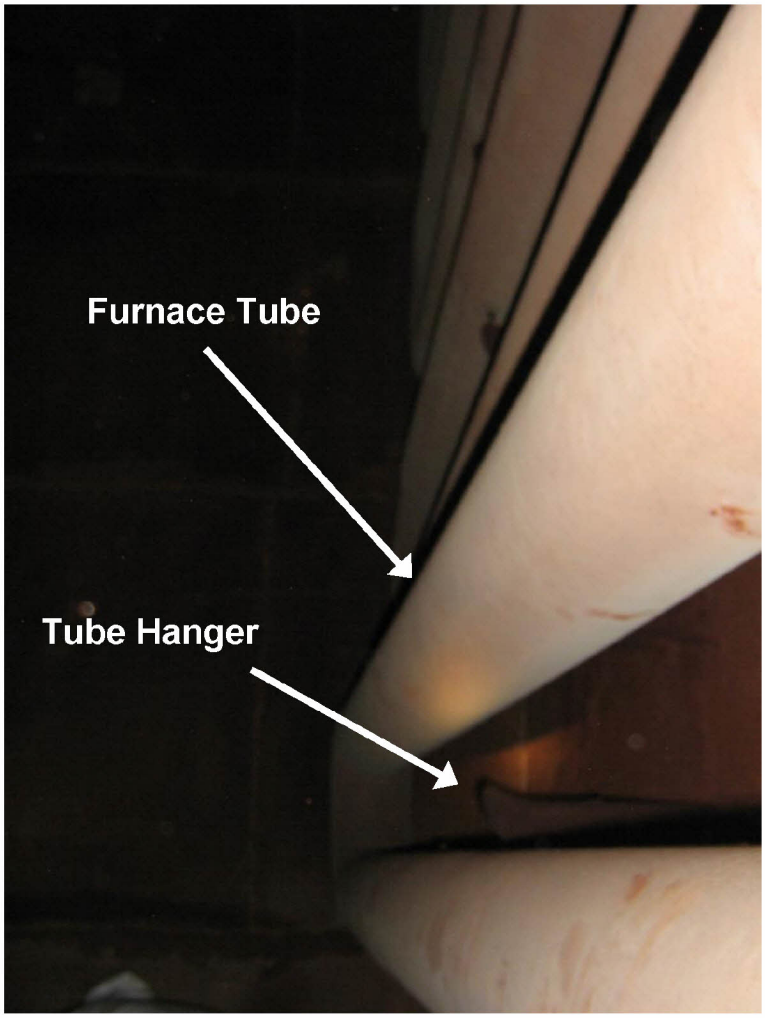


**Figure 6.3.1.2**. Tube not sitting on hanger in F-210A.

### 6.3.2 F-247 Inspections Notes

Furnace was in good shape. There were some small refactory repairs, snuffing steam repairs, and TI replacements. There were some bad burners that can be replaced on the run.

### 6.3.3 F210/F247 – 4" Flange Modification for CEM Project

Replaced two 4" non-standard flanges on each stack with 150# RF flanges in order to add continuous emission monitors (CEM). The current CEM's were relocated to the new 4" flanges, allowing the BAAMQD to have two flanges separated by 90 degrees for random emission testing.

*Ref S/D EWO BF201-E1 Rev. 0*

### 6.3.4 F210A/B – Replace the Corroded Snuffing Steam Lines

All 4 snuffing steam nozzles were replaced on F-210A/B. The nozzles showed excessive corrosion and a few were completely plugged. Some nozzles were replaced to the first flange off of the furnace and some were replaced only to the furnace wall.

*Ref S/D EWO BF-201-E1 Rev. 1*

**RECOMMENDATION:** Consider upgrading metallurgy in the snuffing steam nozzles. The repair appears to be a chronic endeavor.

### 6.3.5 F-247 – Replace the Corroded Snuffing Steam Lines

All 4 snuffing steam nozzles were replaced on F-247. The nozzles showed excessive corrosion and a few were completely plugged. Some nozzles were replaced to the first flange off of the furnace and some were replaced only to the furnace wall.

*Ref S/D EWO BF202-E2 Rev. 1*

**RECOMMENDATION:** Consider upgrading metallurgy in the snuffing steam nozzles. The repair appears to be a chronic endeavor.

### 6.3.6 F-247 – Replace Damaged TI's

The I&E department replaced damaged furnace TI's 36TE435 and 36TE416. TI 36TE435 is located on a roof tube and does not run along the tube and out of the furnace. It is strung perpendicular to the tubes and thus is directly exposed

to the heat from the burners below. If this TI fails again, a redesign would be appropriate.

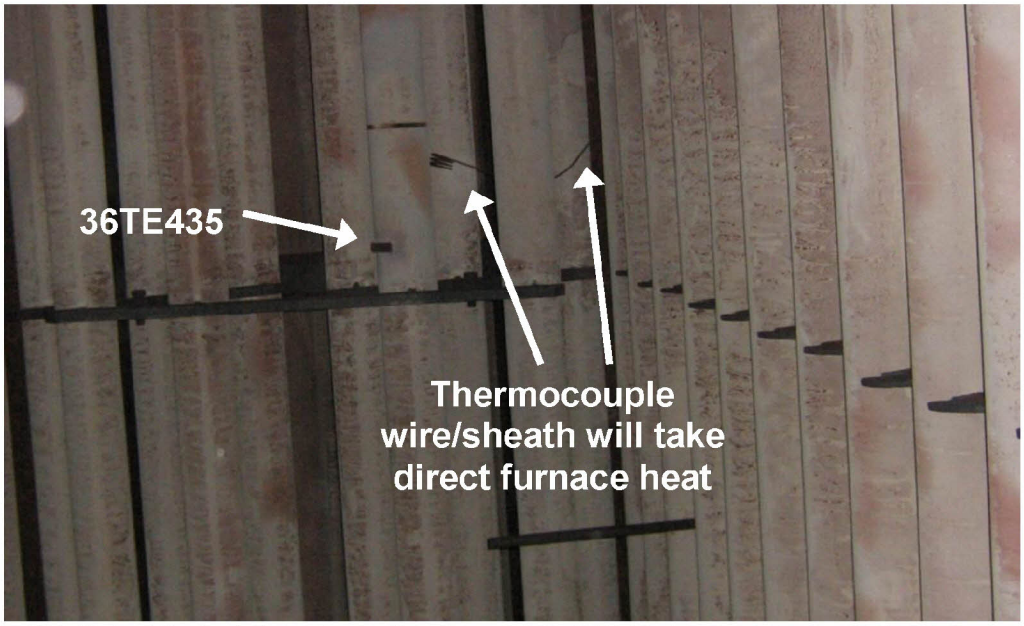


**Figure 6.3.6.1**. Photo taken from the floor of F-247 looking up toward the furnace ceiling.

*Ref S/D EWO BF604-E1*

**RECOMMENDATION:** Redesign the location or route of 36TE435 if the Ti fails again.

## 6.4. Columns and Vessels

### 6.4.1 V-210 – Steam Drum

This vessel was opened, cleaned, and inspected. The internal components were in good shape and needed no major repairs. The continuous blowdown line was missing 1 double nut on a U-bolt and it was replaced. While tightening new nuts on the chevron drier, one of the welded studs snapped off. We replaced the broken stud by drilling a hole and attaching a stud with two nuts, rather than welding in the vessel. All U-bolts on the continuous blowdown line were double nutted, while the chevron driers were single nutted.

There was some corrosion noted on the inside of the steam cyclones where the steam is injected – see **Figure 6.4.1.1**. The corrosion was limited to the centering ring for the demister screen on top of cyclones, so we took no corrective action this shutdown. However, with the centering cylinder corroded

away, the corrosion could spread in the next few years to the outside cylinders, compromising their integrity.

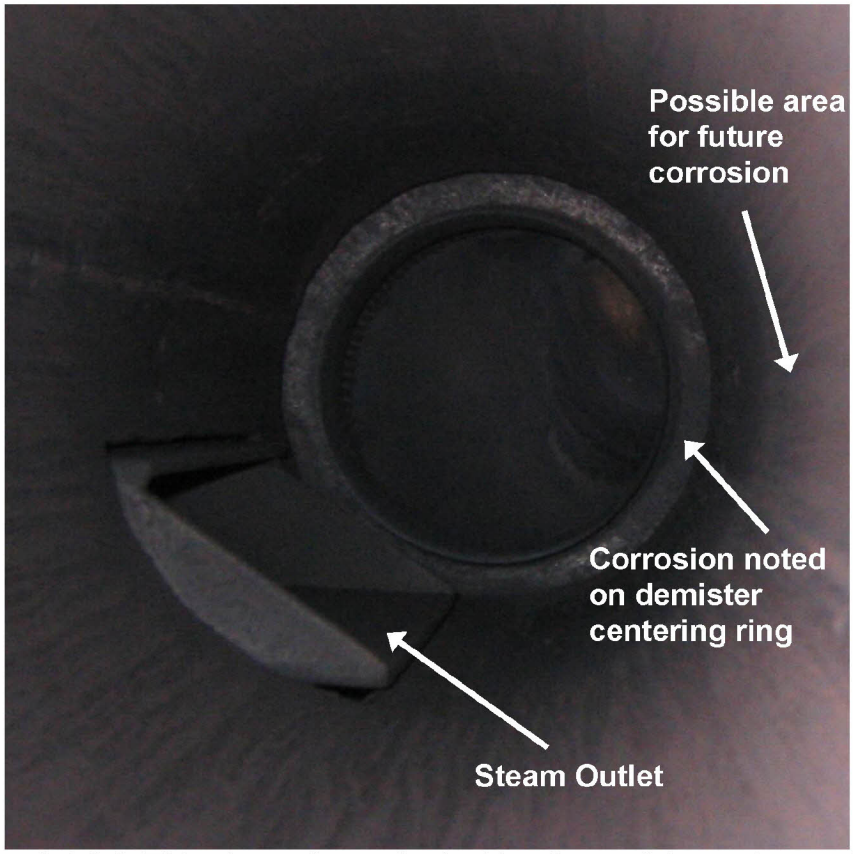


**Figure 6.4.1.1.** This photo shows the inside of one of the cyclones. The photo was taken from the bottom of the cyclone looking up toward the demister pad.

Externally, the vessel needed some weld build and machining on the level gauge tongue and groove flanges. This work was performed by the machine shop. Also, one check valve was replaced on the line from V-210 to F-247.

*Ref S/D EWO BF310-E1 Rev. 0*
*Ref S/D EWO BF310-E2 Rev. 0*

**RECOMMENDATION:** Be aware that cyclones may need replacement next turnaround due to corrosion. Ensure replacement parts are readily available or have replacement parts on-hand.

### 6.4.2 V-220 – High Pressure Separator

V-220 was inspected and found to be in good condition. The Belzona coating that was installed in 2000 was almost all intact (see **Figure 6.4.2.1**). One small section was missing on the impingement plate weld (this may have been

removed for inspection purposes). The only interior work performed was a replacement of the coelescer pad.

Externally there was a problem closing the west manway due to a stuck davit arm. The contractor decided to beat it with a hammer, causing the welded stud on the manway cover to shear, and dropping the manway cover onto the scaffolding. The davit arm was dislodged and a new stud (with full penetration weld) was installed on the cover with double nuts.

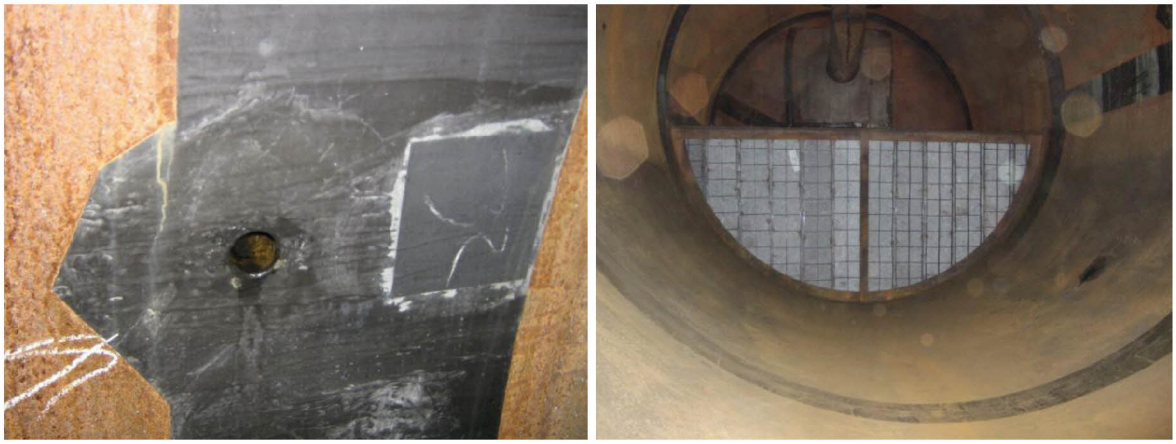

**Figure 6.4.2.1.** Photos of the Belzona coating and the new coelescer pad.

*Ref S/D EWO BF312-E1 Rev. 0*
*Ref S/D EWO BF312-E2 Rev. 0 (mislabeled BF310-E2)*

### 6.4.3 V-240 – Reflux Drum

This vessel was cleaned and inspected. There were no problems found and no discovery work was performed.

### 6.4.4 V-242 – Compressor Knock Out Drum

This vessel was cleaned and inspected and had no notable problems. The only work performed was to replace the demister pad.

*Ref S/D EWO BF315-E1 Rev. 0*

### 6.4.5 V-243 – Compressor Knock Out Drum

This vessel was cleaned and inspected and had no notable problems. The only work performed was to replace the demister pad (see **Figure 6.4.5.1**).

**Figure 6.4.5.1.** This shows the new demister pad as viewed from the bottom of V-243 looking up.

*S/D EWO BF316-E1 Rev. 0*

### 6.4.6 V-244 – Compressor Knock Out Drum

This vessel was cleaned and inspected. The only work performed was to replace the demister pad. There was one loose bolt on the bottom of the vessel. The bolt was tight to the nut but was not clamping correctly (see **Figure 6.4.6.1**). Because the nut was tight and we didn't want to shear the bolt, we decided to leave it loose. In order for the vortex breaker to move, both bolts would need to fail.

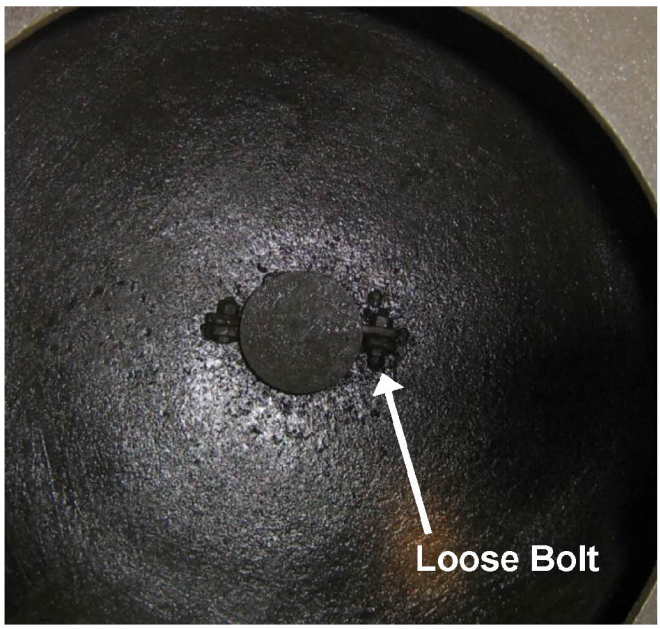


**Figure 6.4.6.1.** Photo of the bottom of V-244.

*Ref S/D EWO BF317-E1 Rev. 0*

**RECOMMENDATION:** Check that both bolts are still installed on the vortex breaker / witches hat on the bottom of the vessel next time it is opened.

### 6.4.7 V-3215 - Deaerator

During the last run, the internal coating of V-3215 failed. The coating appeared to have failed in large spots (1"-9" diameter). **Figure 6.4.7.1** shows the failed coating.

It was determined to replace the coating in-kind with Dampney Apexior Number 1, as the coating is the best solution for the service. The determination was that the last application must have failed either due to inadequate surface preparation or improper curing. The Dampney procedure has a lengthy and complex curing process.

This time, the entire process was monitored by a third party inspector, Bay Area Coating Inspections. The actual work was done by Redwood Painting.

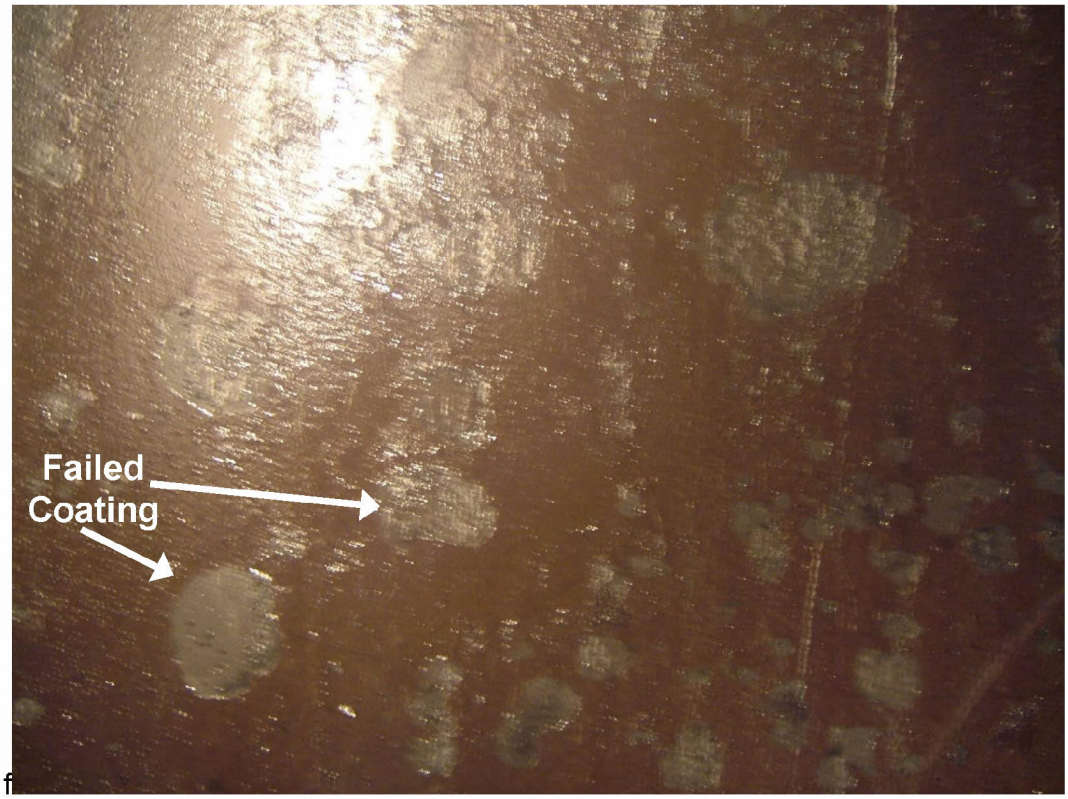


**Figure 6.4.7.1.** Failed coating in V-3215.

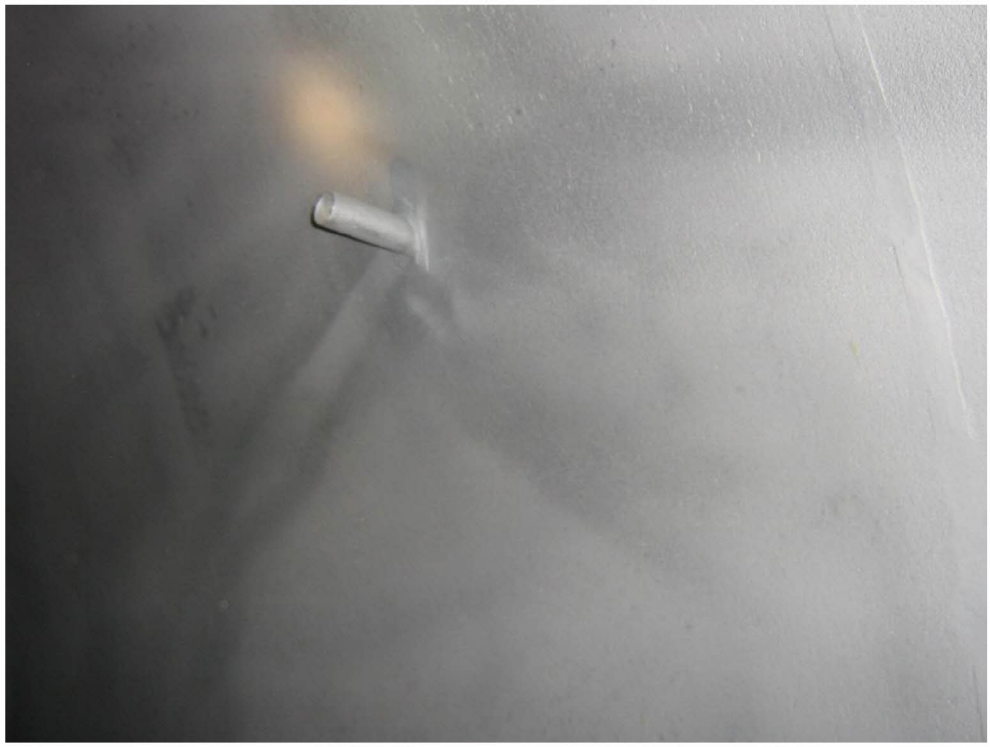

**Figure 6.4.7.2.** Picture of the new coating. – Dampney Apexior Number 1.

In order to coat the bottom outlet of the vessel, it was necessary to remove a strainer that was over the vortex breaker. After conversing with Kansas City Deaerators (KCD), it was determined not to reinstall the strainer. Strainers are not typically installed on similar vessels and Kansas City Deaerators does not install them in new deaerators. The vortex breaker was seal welded and felt very rigid. The photos show before and after the strainer was removed. See **Figures 6.4.7.3 and 6.4.7.4.**

There was some pitting noted in the bottom of the vessel. The largest pit measured 0.18" deep. This pitting should be monitored so that it doesn't become too deep.

**Figure 6.4.7.3.** Strainer covering the water outlet of V-3215.

**Figure 6.4.7.4.** View of the water outlet without the strainer.

One month after start-up, the deaerator experienced a major leak in the top dome. The dome had several cracks propagating from the 2" vent nozzle. After closer inspection, it was revealed that the deaerator had cracks in the head, 2" nozzle piping, and around the 8" water nozzle. It was the opinion of

inspections and metallurgy that the cracks were fatigue induced, not chloride cracking. The entire platform that the deaerator sits on experiences vibration that causes the 8" line and the 2" vent to shake back and forth, stressing the head. Also, there was a separate loud, fast vibration that appeared to be coming from inside the vessel that started right after startup. It is possible that the vibrations either helped propagate or caused the cracking. There was also a one time "event" that occurred in the deaerator that caused extremely loud noise and vibrations to come from the vessel. This "event" occurred when the vessel experienced level control issues. It is possible that the cracks developed during this "event".

The final repair consisted of cutting the head off of the vessel 1 7/8" above where it was originally welded to the dome cylinder. This was done to avoid disturbing the weld for the 8" nozzle. The dome cylinder required some grinding and weld building around the 8" nozzle but none of the cylinder was replaced. A portion of the 1 7/8" of the remaining original head was cut out and a patch was welded in its place. This repair was directly above the 8" nozzle. The 2" vent was cut below the head and a new pipe and flange were welded on. A portion of the vent was replaced with 2" flexible S.S. hose to dampen the vibrations and reduce the stress on the head. The vent support was also improved. See **Figure 6.4.7.5**.

**Figure 6.4.7.5.** New Vent Stack

Because (according to operators) the loud, high frequency vibration started just after startup, and not before the shutdown, all S/D work was reviewed for a

possible cause. The only mechanical change during the S/D was to replace the spray valves. The spray valves were replaced with Kansas City Deaerator Part # H101002-S121489. These valves were replacement-in-kind according to the manufacturer (Kansas City Deaerator became/bought Chicago Heater, the original manufacturer of the vessel).

The replacements provided by KCD were compared to the original valve drawings in the Bechtel Operating manuals and found to differ in shape. KCD was once again contacted and once again confirmed that the valves were correct. Given this shape difference, we decided to order new valves from another manufacturer, Pemco. These valves were exactly the same shape and size as the originals. They also came with a graph showing the same set point as the original valves.

The stiffness of the Pemco valves were compared to the stiffness of the KCD valves and were found to be less than half as stiff as the KCD nozzles. See **Figure 6.4.7.6**. As a result of this test, all of the KCD nozzles in the vessel were replaced with Pemco nozzles. The loud, high frequency vibration stopped after the vessel was started back up. This leads us to believe that the KCD nozzles were too stiff (and possibly chattering) and caused the vessel to vibrate. Pemco nozzles should be used in the future and no parts should be ordered from Kansas City Deaerators.

**Figure 6.4.7.6.** The KCD valve on the left and Pemco valve on the right are both loaded with 2 lbs. At this load the Pemco nozzle is open and would be spraying water. The KCD valve does not even crack at this load.

**Figure 6.4.7.7.** New 316 S/S spray nozzles from Kansas City Deaerators. Nozzles were too stiff and were replaced with nozzles from Pemco Design Services.

**Figure 6.4.7.8.** New 316 S/S nozzles from Pemco Design Services. These nozzles should be used in the future.

*Ref S/D EWO BG317-E1*
*Ref S/D EWO BG317-E2*

**RECOMMENDATION:** Order all spray valves in the future from Pemco Design Services. Do not order any replacement parts from Kansas City Deaerators.

## 6.5. Exchangers

All Heat Exchanger Data was reviewed and update for all the exchanger during this Shutdown. Any gasket changes and torque procedure revisions were documented in the 2 binders labeled D&R 1Q 2007 S/D Heat Exchanger Gasket Info and Updates.

### 6.5.1 E-211A – Cold Feed / Effluent

E-211A was opened, cleaned, and inspected. The channel and shell were in good condition. Inspections reported 20-29% wall loss in 3 tubes and estimated a half wall life of 8.75 years. In the bundle, two tubes were vented and plugged due to rigger corrosion. It appeared that the lifting strap was placed across the tubes, rather than across the baffles. The lamiflex was replaced and the width was changed in the database from 1.75" to 2".

During the hydrotest of E-211A, there was a leak on E-211B. The studs were tightened on E-211B and the leak subsided. E-211B was not entered. The inspection plan was to go into E-211B if E-211A had significant corrosion or other discovery issues that would drive it's opening.

**Figure 6.5.1.1.** Rigger damage on E-211A tube bundle.

**RECOMMENDATION:** Evaluate a possible retube due to thinning tubes. Inspections estimates half life in 8.75 years (for 3 corroded tubes).

### 6.5.2 E-212A/B – Intermediate Feed / Effluent

E-212's were not opened and inspected this turnaround, but it was chemical cleaned. There was an EWO written to remove the nubbins from the shell and channel, but the work was not completed.

During the hydrotest of E-214A/B, E-212A/B had leaks from their gasket surfaces (shell to bundle). The leaks were corrected by tightening the studs on E-212A/B.

Calculations were performed for changing the gaskets from Clad to CMG. The Heat exchanger Data Base will be changed back to reflect the current Clad Gaskets in the field. The recommended gasket change and torque values are located in the binder "1Q 2007 Heat Exchanger Gasket and Info Update," Book 2 of 2, and the drop files in the D&R Library. The next time the exchangers are inspected would be the best opportunity to upgrade gaskets. If at all possible try to upgrade the A&B exchanger gasketing at the same time.

*Ref S/D EWO BF409-E2*
*Ref S/D EWO BF409-E3*

**RECOMMENDATION:** Remove the nubbins from E-212A/B next shutdown.

### 6.5.3 E-214A/B – Splitter Feed / Effluent

E-214A was opened, cleaned, and inspected. The bundle showed 20-29% wall loss in 15 tubes (2.8%), giving an estimated half life of 5-7 years. Due to the corrosion found in A, the B bundle was pulled, cleaned, and inspected. No tubes need to be plugged in the B bundle. The lamiflex was replaced in-kind with S/S.

The channels from both exchangers were sent to Benicia Fab to have the nubblins removed. In addition, the baffle in the A channel was straightened. Only the first few inches of the baffle (starting from the tube sheet side) was bent and most likely due to mechanical damage. The B channel baffle was not bent and was in good shape.

The shell nubblins were removed in the field by Dresser Rand Field Services. Both shells were significantly out of round and not flat. This resulted in slightly more metal being removed than we would have preferred (~.020"). The final depth of the gasket surface in relation to the flange face was .225" on E-412A and .221" ave on E-214 B. All gasket and torque information was updated on the Heat Exchanger Data Base.


**Figure 6.5.3.1** Nubbin on E-214A shell before removal.

*Ref S/D EWO BF415-E1 Rev. 0*
*Ref S/D EWO BF415-E2 Rev. 0*
*Ref S/D EWO BF415-E3 Rev. 0*

**RECOMMENDATION:** Evaluate the whether a retube in necessary for next turnaround. The bundles were last replaced in 4Q 2000. A bundle had 15 tubes with 20-29% wall loss, giving a half live of 5-7 years. Bundle only have 5 years of service, so examine metallurgy as well.

**RECOMMENDATION:** There were a lot of gasket leaks in exchangers that were not opened but required a hydrotest because they are stacked with an exchanger that was opened. It would be prudent to have all gaskets on hand for exchangers that are hydrotested, even if they are not opened. It might also be beneficial to lower the hydrotest pressure on stacked exchangers.

### 6.5.4 E-216A-F – Reactor Effluent Cooler

Pulled 20% of the header plugs, hydroblasted, inspected, and closed. There were no problems noted.

### 6.5.5 E-240A-D – Splitter Overhead Condenser

Exchangers were retubed. See Capital section 6.1 or this report and the drop file in the D&R library labeled "E-240 Retube".

*Ref S/D EWO BF426-E1 Rev. 0*
*Ref S/D EWO BF426-E2 Rev. 1*

### 6.5.6 E-242 – Compressor Aftercooler

Pulled 100% of the header plugs, hydroblasted, inspected, and closed. No problems were noted.

### 6.5.7 E-245 – Seal Flush Oil Cooler

Exchanger was replaced in-kind. See the Capital Section 6.1 of this report.

*Ref S/D EWO BF433-E1 Rev. 0*
*Ref S/D EWO BF433-E2 Rev. 0*

### 6.5.8 E-248A-E – Cold Stripper Feed / Bottoms

Pulled the A and E bundles, cleaned, and inspected. No corrosion was noted on the shells or channels. The A bundle had 4 tubes with 20-29% wall loss, and 3 obstructed tubes that were plugged. Inspection estimates 7.8 years to half wall life. The E bundle showed no significant wall loss. The lamiflex was replaced in both bundles and the length and width were changed to 234.25" and 2".

During the hydrotest, the tube sheet to shell gasket on E-248B blew out. The channel was pulled and a new gasket was installed by slipping it over the tubesheet. The hydrotests were successfully bought off after the new gasket was installed.

During the hydrotest, it was found that the drain valve on E-248E leaked by. The valve was removed and a new valve was welded into place.

*Ref S/D EWO BF439-E1 Rev. 0*

**RECOMMENDATION:** Evaluated a possible retube in E-248A bundle due to thinning tubes. 4 tubes at 20-29% wall loss with an estimated remaining life of 7.8 years. Review inspections data before making decision.

**RECOMMENDATION:** There were a lot of gasket leaks in exchangers that were not opened but required a hydrotest because they are stacked with an exchanger that was opened. It would be prudent to have all gaskets on hand for exchangers that are hydrotested, even if they are not opened. It might also be beneficial to lower the hydrotest pressure on stacked exchangers.

### 6.5.9 E-249 A-D – Diesel Product Cooler

Pulled 20% of the header plugs on the A bundle, hydroblasted, inspected, and closed. No issues discovered.

### 6.5.10 E-256 – Jet Product Cooler

Pulled 20% of the header plugs, hydroblasted, inspected, and closed. No issues discovered.

### 6.5.11 E-257 – Jet Stripper Reboiler

Exchanger was pulled, disassembled, cleaned, and inspected. During disassembly, the exchanger bellows was damaged. A new bellows was ordered from Expansion Joint System. Benicia Fabrication installed the new

bellows and assembled the exchanger. One tube was plugged and vented because it was obstructed. The bundle life was estimated at 23 years.

An EWO was created to remove the nubbins from the floating head. This included the FLHD to FLTS connection and the tail pipe flange to Pot connection. Once the exchanger was disassembled if was discovered that the nubbin on the FLHD to FLTS had already been removed. The nubbin was removed from the tail pipe flange and gasketed with a Kamprofile.

Note: there is always good value in watching the contractor pull apart heat exchangers with bellows and talking with them to make sure they understand how they come apart. The damage to the bellow was accomplished with a pry bar and easily avoidable. The damaged bellows added about $25,000-$30,000 to the job.

**Figure 6.5.11.1.** Damaged bellows after removal.

There was an EWO written to repair the nubbins on the floating head. After disassembly, it was found that the nubbins had been previously removed.

*Ref S/D EWO BF446-E1*
*Ref S/D EWO BF446-E2 Rev. 1*

## 6.6. Future Recommendations

**Note**: Recommendations are listed and justified in the equipment summaries. The list below is to serve as a quick summary of all recommendations.

### 6.1 Piping

- **Process Valves**

Large amounts of valves were added to the worklist as a result of hydrotesting against old valves. I would recommend that all flanged valves are blinded rather than blocked in. This should reduce the number of valves replaced.

- **P-257 Seal Flush Piping**

Consider replacing the ½" needle valve with a ¾" needle valve next turnaround. ¾" needle valve has a 10 week lead time.

- **Isolate Unused Equipment**

Get from Craig.

### 6.2 Furnaces

- F-210A/B and F-247

Consider upgrading the metallurgy of the snuffing steam nozzles. The repair appears to be a chronic endeavor. The current metallurgy is 316 S/S

- F-247

Redesign or route of 36TE435 if the Ti fails again

### 6.3 Vessels

- V-210

Be aware that steam cyclones may need replacement next turnaround due to corrosion. Have replacement parts on-hand.

- V-244

Check that both bolts are still installed on the vortex breaker / witches hat on the bottom of the vessel next time it is opened.

- V-3215

Order all spray valves in the future from Pemco Design Services. Do not order any replacement parts from Kansas City Deaerators.

### 6.4 Exchangers

- E-211A/B

Evaluate a possible retube due to thinning tubes. Inspections estimates half life in 8.75 years (for 3 corroded tubes). Review inspection data before making decision.

- E-212A/B

Remove the nubbins off of the shell and channel of the exchanger. An EWO was written for this shutdown but the job was not completed. The exchanger was not opened.

- E-214A/B

Evaluate the whether a retube in necessary for next turnaround. The bundles were last replaced in 4Q 2000. A bundle had 15 tubes with 20-29% wall loss, giving a half live of 5-7 years. Bundle only have 5 years of service, so examine metallurgy as well.

- E-248A-E

Evaluate a possible retube in E-248A bundle due to thinning tubes. 4 tubes at 20-29% wall loss with an estimated remaining life of 7.8 years. Review inspections data before making decision.

- Stacked Exchangers

There were a lot of gasket leaks in exchangers that were not opened but required a hydrotest because they are stacked with an exchanger that was opened. It would be prudent to have all gaskets on hand for exchangers that are hydrotested, even if they are not opened. It might also be beneficial to lower the hydrotest pressure on stacked exchangers.